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FAIRCHILD SEMICONDUCTOR™

October 1987
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MM74C174
Hex D-Type Flip-Flop

General Description

The MM74C174 hex D-type flip-flop is a monolithic complementary MOS (CMOS) integrated circuit constructed with N- and P-channel enhancement transistors. All have a direct clear input. Information at the D inputs meeting the setup time requirements is transferred to the Q outputs on the positive-going edge of the clock pulse. Clear is independent of clock and accomplished by a low level at the clear input. All inputs are protected by diodes to V_{CC} and GND.

Features

- Wide supply voltage range: 3.0V to 15V
- Guaranteed noise margin: 1.0V
- High noise immunity: 0.45 V_{CC} (typ.)
- Low power TTL compatibility:
  Fan out of 2 driving 74L

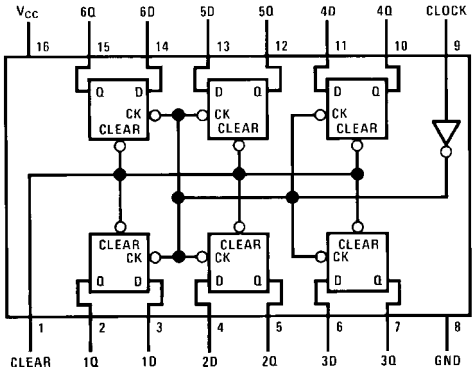
Ordering Code:

Order Number	Package Number	Package Description
MM74C174M	M16A	16-Lead Small Outline Integrated Circuit (SOIC), JEDEC MS-012, 0.150" Narrow
MM74C174N	N16E	16-Lead Plastic Dual-In-Line Package (PDIP), JEDEC MS-001, 0.300" Wide

Device also available in Tape and Reel. Specify by appending suffix letter "X" to the ordering code.

Connection Diagram

Pin Assignments for DIP and SOIC



Top View

Truth Table

Inputs			Output
Clear	**Clock**	**D**	**Q**
L	X	X	L
H	↑	H	H
H	↑	L	L
H	L	X	Q

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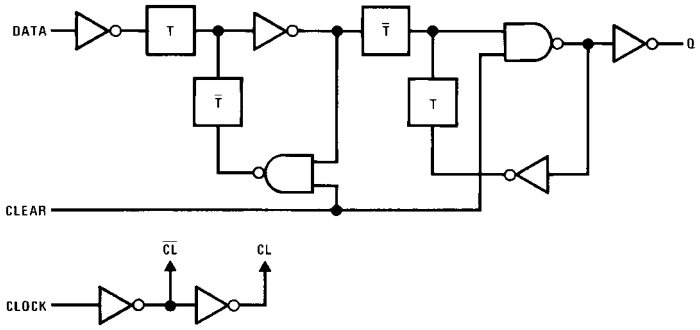
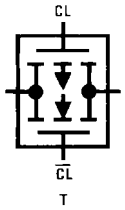
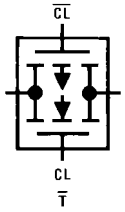
Logic Diagrams







Absolute Maximum Ratings (Note 1)

Voltage at Any Pin	−0.3V to V_{CC} +0.3V
Operating Temperature Range	−40°C to +85°C
Storage Temperature Range	−65°C to +150°C
Power Dissipation (P_D)	
Dual-In-Line	700 mW
Small Outline	500 mW
Operating V_{CC} Range	3.0V to 15V
Absolute Maximum V_{CC}	18V
Lead Temperature	
(Soldering, 10 seconds)	260°C

Note 1: "Absolute Maximum Ratings" are those values beyond which the safety of the device cannot be guaranteed. Except for "Operating Temperature Range" they are not meant to imply that the devices should be operated at these limits. The Electrical Characteristics table provides conditions for actual device operation.

DC Electrical Characteristics

Min/Max limits apply across temperature range unless otherwise specified

Symbol	Parameter	Conditions	Min	Typ	Max	Units
CMOS TO CMOS						
$V_{IN(1)}$	Logical "1" Input Voltage	V_{CC} = 5V	3.5			V
		V_{CC} = 10V	8.0			V
$V_{IN(0)}$	Logical "0" Input Voltage	V_{CC} = 5V			1.5	V
		V_{CC} = 10V			2.0	V
$V_{OUT(1)}$	Logical "1" Output Voltage	V_{CC} = 5V, I_O = −10 μA	4.5			V
		V_{CC} = 10V, I_O = −10 μA	9.0			V
$V_{OUT(0)}$	Logical "0" Output Voltage	V_{CC} = 5V, I_O = 10 μA			0.5	V
		V_{CC} = 10V, I_O = 10 μA			1.0	V
$I_{IN(1)}$	Logical "1" Input Current	V_{CC} = 15V, V_{IN} = 15V		0.005	1.0	μA
$I_{IN(0)}$	Logical "0" Input Current	V_{CC} = 15V, V_{IN} = 0V	−1.0	−0.005		μA
I_{CC}	Supply Current	V_{CC} = 15V		0.05	300	μA
CMOS/LPTTL INTERFACE						
$V_{IN(1)}$	Logical "1" Input Voltage	V_{CC} = 4.75V	V_{CC}−1.5			V
$V_{IN(0)}$	Logical "0" Input Voltage	V_{CC} = 4.75V			0.8	V
$V_{OUT(1)}$	Logical "1" Output Voltage	V_{CC} = 4.75V, I_O = −360 μA	2.4			V
$V_{OUT(0)}$	Logical "0" Output Voltage	V_{CC} = 4.75V, I_O = 360 μA			0.4	V
OUTPUT DRIVE (See Family Characteristics Data Sheet) (short circuit current)						
I_{SOURCE}	Output Source Current	V_{CC} = 5V	−1.75	−3.3		mA
	(P-Channel)	T_A = 25°C, V_{OUT} = 0V				
I_{SOURCE}	Output Source Current	V_{CC} = 10V	−8.0	−15		mA
	(P-Channel)	T_A = 25°C, V_{OUT} = 0V				
I_{SINK}	Output Sink Current	V_{CC} = 5V	1.75	3.6		mA
	(N-Channel)	T_A = 25°C, V_{OUT} = 0V				
I_{SINK}	Output Sink Current	V_{CC} = 5V	8.0	16		mA
	(N-Channel)	T_A = 25°C, V_{OUT} = 0V				

AC Electrical Characteristics (Note 2)

$T_A = 25°C$, $C_L = 50$ pF, unless otherwise noted

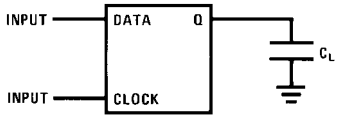
Symbol	Parameter	Conditions	Min	Typ	Max	Units
t_{pd}	Propagation Delay Time to a Logical	$V_{CC} = 5V$		150	300	ns
	"0" or Logical "1" from Clock to Q	$V_{CC} = 10V$		70	110	ns
t_{pd}	Propagation Delay Time to	$V_{CC} = 5V$		110	300	ns
	a Logical "0" from Clear	$V_{CC} = 10V$		50	110	ns
t_{S1}, t_{S0}	Time Prior to Clock Pulse that	$V_{CC} = 5V$	75			ns
	Data Must be Present	$V_{CC} = 10V$	25			ns
t_{H1}, t_{H0}	Time after Clock Pulse	$V_{CC} = 5V$	0	−10		ns
	that Data Must be Held	$V_{CC} = 10V$	0	−5.0		ns
t_W	Minimum Clock Pulse Width	$V_{CC} = 5V$		50	250	ns
		$V_{CC} = 10V$		35	100	ns
t_W	Minimum Clear Pulse Width	$V_{CC} = 5V$		65	140	ns
		$V_{CC} = 10V$		35	70	ns
t_r, t_f	Maximum Clock Rise and	$V_{CC} = 5V$	15	>1200		µs
	Fall Time	$V_{CC} = 10V$	5.0	>1200		µs
f_{MAX}	Maximum Clock Frequency	$V_{CC} = 5V$	2.0	6.5		MHz
		$V_{CC} = 10V$	5.0	12		MHz
C_{IN}	Input Capacitance	Clear Input (Note 3)		11		pF
		Any Other Input		5.0		pF
C_{PD}	Power Dissipation Capacitance	Per Package (Note 4)		95		pF

Note 2: AC Parameters are guaranteed by DC correlated testing.

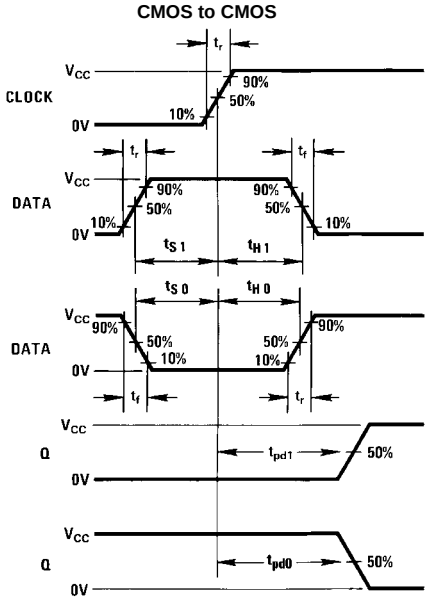
Note 3: Capacitance is guaranteed by periodic testing.

Note 4: C_{PD} determines the no load AC power consumption of any CMOS device. For complete explanation see Family Characteristics Application Note AN-90.

AC Test Circuit

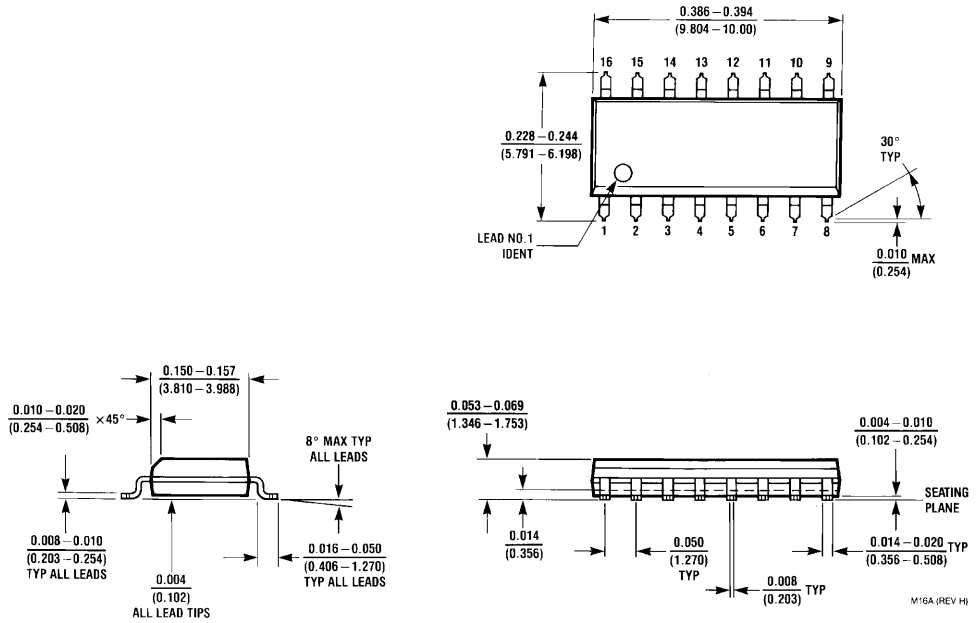


Switching Time Waveforms



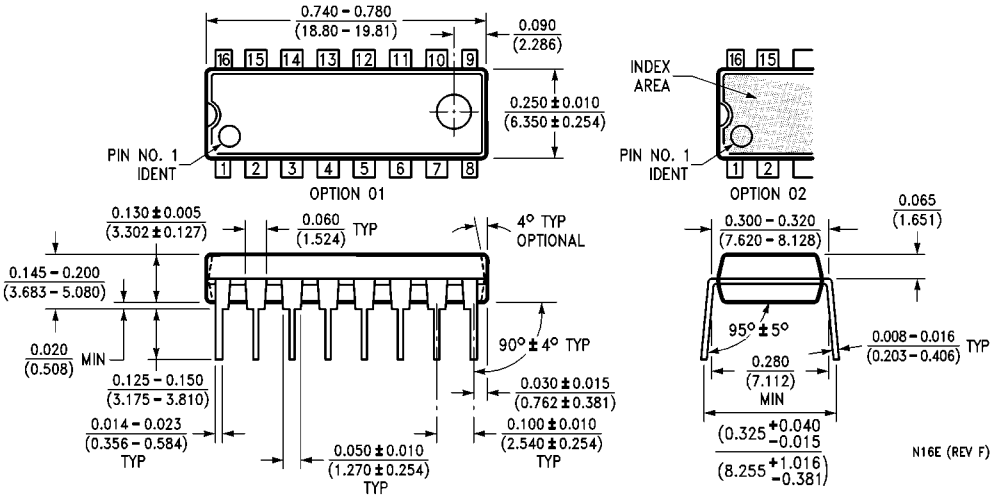
$t_r = t_f = 20$ ns

Physical Dimensions inches (millimeters) unless otherwise noted



16-Lead Small Outline Integrated Circuit (SOIC), JEDEC MS-012, 0.150" Narrow
Package Number M16A

Physical Dimensions inches (millimeters) unless otherwise noted (Continued)



16-Lead Plastic Dual-In-Line Package (PDIP), JEDEC MS-001, 0.300" Wide
Package Number N16E

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